Pilot Remediation Work Plan For Huster Rd. Substation

Huster Road Substation

St. Charles, MO 63301

January 2023

Prepared for

Ameren Missouri

1901 Chouteau Avenue

St. Louis, MO 63103

Loureiro

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An Employee-Owned Company

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1. INTRODUCTION

Loureiro Engineering Associates (LEA) has prepared this Pilot In-Situ Chemical Reduction (ISCR) Work Plan for remedial evaluation in the Huster Road Substation (work plan) on behalf of Ameren Missouri (Ameren). The work plan presents a summary of the proposed remedial approach to treat residual groundwater impacts within the Huster Road Substation property on Huster Road in St. Charles, Missouri (site) (**Figure 1**). The primary contaminants of concern (COCs) to be treated at the site are 1,2-cis-dichloroethene (cis-1,2-DCE) and vinyl chloride.

2. SITE CONCEPTUAL MODEL

The geology of the site consists of a silty clay/silt material 25 to 32 feet in thickness. The lower two to three feet transitions to a primarily silt composition. Underlying the cohesive unit is a medium grained sand material that extends from approximately 32 feet below ground surface (ft bgs) to the top of bedrock observed at approximately 110 ft bgs. The depth to groundwater at the site varies, dependent on the Mississippi River fluctuation located approximately 2 miles north but is typically encountered at approximately 20 feet bgs.

2.1 Site Background

COC impacts in groundwater were first observed in 2010 during routine groundwater sampling activities from City Well 5. Since then, several investigations to further delineate the groundwater plume were performed, followed by several pilot and full-scale injection applications of various in situ remediation technologies.

3. ISCR OBJECTIVES

The Groundwater Extraction and Treatment System (GETS) was designed to contain and treat groundwater from the substation as it flows naturally to the north/northwest and as influenced by City of St. Charles (City) production wells located downgradient ~~and upgradient~~ of the substation. Ameren's primary objective of the ISCR application is to create a permeable reactive barrier on the northeast portion of the substation berm to address potential residual COC impacts in groundwater (**Figure 1**) flowing both naturally to the north and affected by variable operations of the well field. Using the groundwater program data, the estimated remaining mass of COCs in groundwater on the 8-acre Site is approximately 4 pounds (lbs.). This represents a 99% reduction of estimated COCs mass in groundwater from approximately 400 lbs prior to remedial efforts.

4. REMEDIAL DESIGN OVERVIEW

Just beyond the northeastern portion of the levee control, enhanced reductive dechlorination (ERD) will be applied by the injection of a zero valent iron (ZVI) product EHC®. EHC® is a product that combines ZVI, controlled-release carbon, and nutrients to promote strong reducing conditions when applied in subsurface environments where biodegradation is ongoing. Injections will be performed via direct push injection points through direct push drilling rods or similar equipment. Granular form EHC® will be delivered to the site in 50-pound bags, batched into a slurry with potable water, and injected via a grout injection pump (or similar).

EHC® injection points will be spaced 12.5 feet on-center for optimal amendment distribution with an assumed radius of influence (ROI) of approximately 6 feet (**Figure 1**). The assumed ROI for each injection point may vary based upon subsurface conditions. In order to obtain proper vertical distribution, several gallons of EHC® slurry will be injected every few feet across the target interval. Rods will be advanced to greatest depth, upon reaching that depth a dispensable tip will be release allow for injection through a specialized tip. The drilling rods will be retrieved on 2-foot intervals with material injected during each lift. The material will be injected until the lift volume is complete or pressures reach 200 pounds per square inch (PSI). The EHC® injections are designed to create a permeable barrier for groundwater flow by naturally conditions or modified by pumping. EHC® is composed of controlled-release carbon, ZVI particles and nutrients used for stimulating ISCR of otherwise persistent organic compounds in groundwater. Following placement of EHC® into the subsurface environment, a number of physical, chemical and microbiological processes combine to create very strong reducing conditions that stimulate rapid and complete dechlorination of organic solvents ~~and other recalcitrant compounds (e.g., explosives and organochlorine pesticides).~~

Particle flow modeling based of multiple rate and well variations of the adjacent municipal wells indicate impact present within remain within the upper 10 feet of the sand unit within the substation regardless of municipal well field pumping scenario. Should particles reach a point of approximately 90 feet from a well, the well influence affects the flow in a downward draw to the pump depth. To provide a conservative enhancement of the dichlorination process and ensure that the presence of impact does not reach this drawdown range, the application of EHC® will be ~~in~~ placed in a strategic location for potential migration and extend to a depth greater than three (3) times the anticipated particle path. Because of the location of the barrier relative to the well field and its composition of carbon, iron, and nutrients, the barrier poses no operational concerns to any well in the area.

4.1 Proposed ISCR Application

The proposed ISCR application is described as:

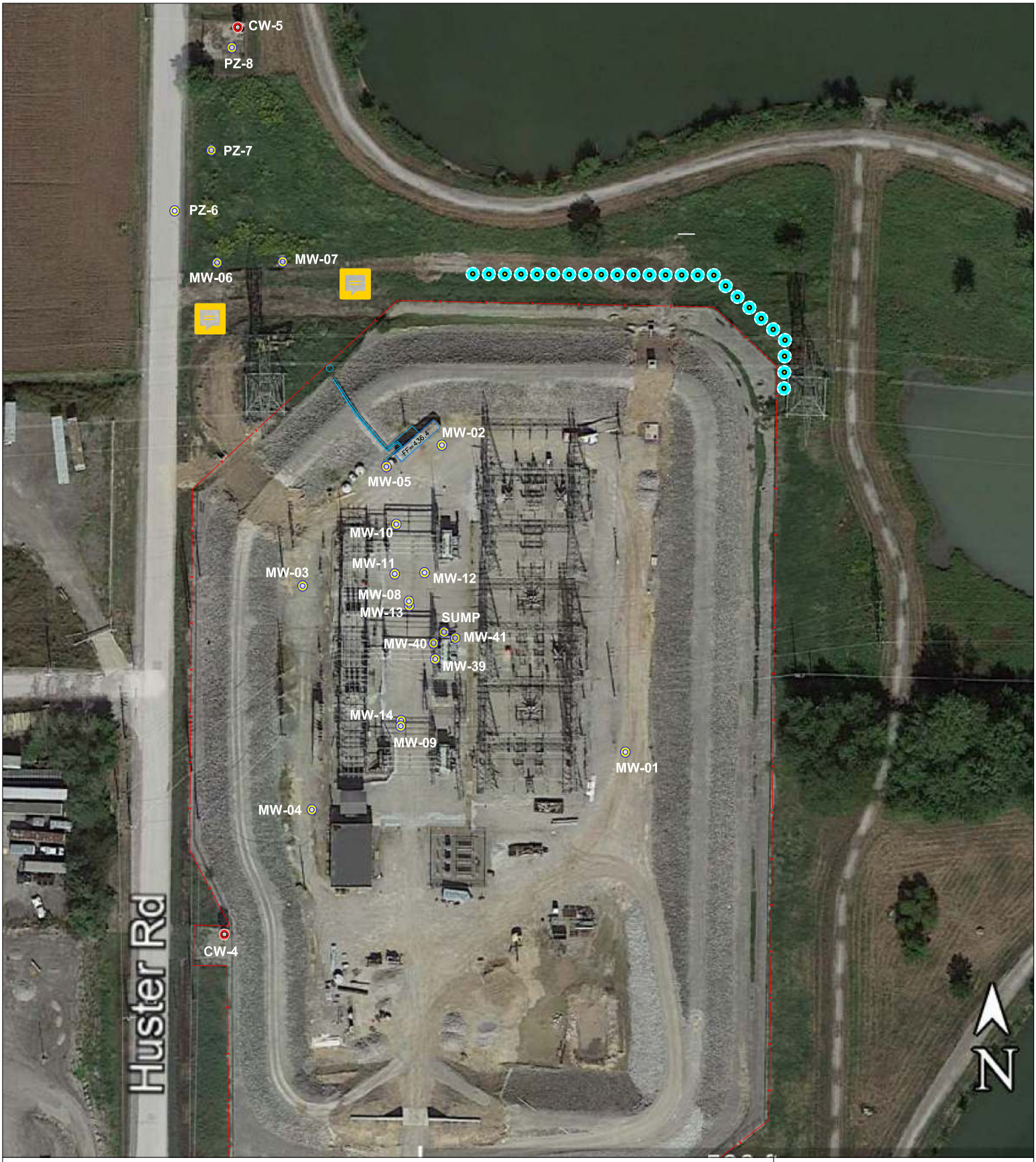
- EHC® will be used to treat groundwater in the target vertical interval underlying the substation prior to the potential for offsite migration. The target treatment interval is approximately 30 feet, extending from 32 ft bgs to 62 ft bgs and may vary depending on the thickness of the overlying silty clay layer.
- A total of 41,250 lb. of EHC® will be applied at the site, evenly distributed between 25 injection locations.
- Each injection location is expected to receive approximately 1,650 lb. of EHC® in a slurry mixture of up to 1,000 gallons. The volume of slurry applied may vary between locations.
- Should a location not accept the total volume anticipated, attempts will be made to place remaining volume in the adjacent boring.
- Lift intervals of 2 feet between injection.
- Maximum pressure of 200 psi.
- Upon completion of the injection, all injection boreholes will be backfilled in accordance with state regulations.

5. PILOT TEST SCHEDULE

The schedule and estimated task duration is presented below. LEA can be prepared to start the mobilization portion of the ISCO pilot test the week of February 2, 2023.

Task	**Date (duration)**
ISCR Pilot Application	
Preparations and Procurement	January 2023
Product Delivery	February 2, 2023
Mobilization	February 6, 2023
ISCR Application	February 6 through February 20, 2023
Site Demobilization	March 10, 2023

FIGURE



LEGEND

PROPOSED EHC INJECTION LOCATION (ASSUMED 5 FT ROI)

PZ-11 MONITORING WELL

CW-6 CITY WELL

NOTES:

1. Radius of influence (ROI) per injection location is assumed at 5 feet based on proposed injection volumes and assumed soil porosity.

0 100

SCALE (FEET)

Loureiro

SCALE: AS SHOWN	TITLE: SITE PLAN ISCR TREATMENT AREA - SUBSTATION HUSTER RD. ST. CHARLES, MO
DATE: JANUARY 2023	
PROJECT NO.: 088UE2.08	
CLIENT: AMEREN	
DRAWN BY: PC	DRAWING NO. FIGURE 1
CHECKED BY: DI	REV.
APPROVED BY: DI	